WHAT IS CLAIMED IS:

1. An apparatus for coding a 5-bit input information bit stream into a (12,5) codeword comprised of 12 coded symbols, comprising:

a Reed-Muller encoder for receiving the 5-bit input information bit stream and creating a first order Reed-Muller codeword comprised of 16 coded symbols; and

a puncturer for outputting an optimal (12,5) codeword by puncturing 4 consecutive coded symbols from a stream of the 16 coded symbols comprising the first order Reed-Muller codeword, beginning at a coded symbol selected from 1^{st}, 3^{rd}, 5^{th}, 7^{th}, 9^{th} and 11^{th} coded symbols.

2. The apparatus as claimed in claim 1, wherein the puncturer punctures 1^{st}, 2^{nd}, 3^{rd} and 4^{th} coded symbols.

3. The apparatus as claimed in claim 1, wherein the Reed-Muller encoder comprises:

an orthogonal codeword generator for generating orthogonal codewords each comprised of 16 coded symbols, by multiplying 4 bits out of the 5-bit input information bit stream by associated base orthogonal codes W1, W2, W4 and W8, respectively;

a code generator for generating an All 1's code; and

an adder for outputting the first order Reed-Muller codeword, 16 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the result of multiplying a remaining one bit of the input information bit stream by the All 1's code.

4. A method for coding a 5-bit input information bit stream into a (12,5) codeword comprised of 12 coded symbols, comprising the steps of:

receiving the 5-bit input information bit stream and creating a first order Reed-Muller codeword comprised of 16 coded symbols; and

outputting an optimal (12,5) codeword by puncturing 4 consecutive coded symbols from a stream of the 16 coded symbols comprising the first order Reed-Muller codeword, beginning at a coded symbol selected out of 1st, 3rd, 5th, 7th, 9th and 11th coded symbols.

5. The method as claimed in claim 4, wherein the punctured coded symbols include 1st, 2nd, 3rd and 4th coded symbols.

6. The method as claimed in claim 4, wherein the step of generating the first order Reed-Muller codeword comprises the steps of:

generating orthogonal codewords, each comprised of 16 coded symbols, by multiplying 4 bits out of the 5-bit input information bit stream by associated base orthogonal codes W1, W2, W4 and W8, respectively;

multiplying the remaining one bit of the input information bit stream by an All 1's code; and

outputting the first order Reed-Muller codeword, 16 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the result of multiplying a remaining one bit of the input information bit stream by the All 1's code.

7. An apparatus for coding a 5-bit input information bit stream into a (12,5) codeword comprised of 12 coded symbols, comprising:

a Reed-Muller encoder for receiving the 5-bit input information bit stream

and generating a first order Reed-Muller codeword comprised of 16 coded symbols; and

a puncturer for outputting an optimal (12,5) codeword by puncturing a selected coded symbol out of 2nd, 3rd, 6th and 7th coded symbols from a stream of the 16 coded symbols comprising the first order Reed-Muller codeword, and also puncturing 3 coded symbols at intervals of 2 symbols beginning at the selected coded symbol.

8. The apparatus as claimed in claim 7, wherein the puncturer punctures 2nd, 4th, 6th and 8th coded symbols.

9. The apparatus as claimed in claim 7, wherein the Reed-Muller encoder comprises:

an orthogonal codeword generator for generating orthogonal codewords, each comprised of 16 coded symbols, by multiplying 4 bits out of the 5-bit input information bit stream by associated base orthogonal codes W1, W2, W4 and W8, respectively;

a code generator for generating an All 1's code; and

an adder for outputting the first order Reed-Muller codeword, 16 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the orthogonal codewords and the result of multiplying a remaining one bit of the input information bit stream by the All 1's code.

10. A method for coding a 5-bit input information bit stream into a (12,5) codeword comprised of 12 coded symbols, comprising the steps of:

receiving the 5-bit input information bit stream and generating a first order Reed-Muller codeword comprised of 16 coded symbols; and

outputting an optimal (12,5) codeword by puncturing a selected coded symbol out of 2^{nd}, 3^{rd}, 6^{th} and 7^{th} coded symbols from a stream of the 16 coded symbols comprising the first order Reed-Muller codeword, and also puncturing 3 coded symbols at intervals of 2 symbols beginning at the selected coded symbol.

11. The method as claimed in claim 10, wherein the punctured coded symbols include 2^{nd}, 4^{th}, 6^{th} and 8^{th} coded symbols.

12. The method as claimed in claim 10, wherein the step of generating the first order Reed-Muller codeword comprises the steps of:

generating orthogonal codewords, each comprised of 16 coded symbols, by multiplying 4 bits out of the 5-bit input information bit stream by associated base orthogonal codes W1, W2, W4 and W8, respectively;

multiplying the remaining one bit of the input information bit stream by an All 1's code; and

outputting the first order Reed-Muller codeword, 16 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the orthogonal codewords and the result of multiplication.

13. An apparatus for coding a 5-bit input information bit stream into a (12,5) codeword comprised of 12 coded symbols, comprising:

a Reed-Muller encoder for receiving the 5-bit input information bit stream and generating a first order Reed-Muller codeword comprised of 16 coded symbols; and

a puncturer for outputting an optimal (12,5) codeword by puncturing a selected coded symbol out of 0^{th}, 1^{st}, 2^{nd}, 4^{th}, 5^{th} and 6^{th} coded symbols from a stream of the 16 coded symbols comprising the first order Reed-Muller codeword,

and also puncturing 3 coded symbols at intervals of 3 symbols beginning at the selected coded symbol.

14. The apparatus as claimed in claim 13, wherein the puncturer punctures 0^{th}, 3^{rd}, 6^{th} and 9^{th} coded symbols.

15. The apparatus as claimed in claim 13, wherein the Reed-Muller encoder comprises:

an orthogonal codeword generator for generating orthogonal codewords, each comprised of 16 coded symbols, by multiplying 4 bits out of the 5-bit input information bit stream by associated base orthogonal codes W1, W2, W4 and W8, respectively;

a code generator for generating an All 1's code; and

an adder for outputting the first order Reed-Muller codeword, 16 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the orthogonal codewords and the result of multiplying a remaining one bit of the input information bit stream by the All 1's code.

16. A method for coding a 5-bit input information bit stream into a (12,5) codeword comprised of 12 coded symbols, comprising the steps of:

receiving the 5-bit input information bit stream and generating a first order Reed-Muller codeword comprised of 16 coded symbols; and

outputting an optimal (12,5) codeword by puncturing a selected coded symbol out of 0^{th}, 1^{st}, 2^{nd}, 4^{th}, 5^{th} and 6^{th} coded symbols from a stream of the 16 coded symbols comprising the first order Reed-Muller codeword, and also puncturing 3 coded symbols at intervals of 3 symbols beginning at the selected coded symbol.

17. The method as claimed in claim 16, wherein the punctured coded symbols include 0^{th}, 3^{rd}, 6^{th} and 9^{th} coded symbols.

18 The method as claimed in claim 16, wherein the step of generating the first order Reed-Muller codeword comprises the steps of:

generating orthogonal codewords, each comprised of 16 coded symbols, by multiplying 4 bits out of the 5-bit input information bit stream by associated base orthogonal codes W1, W2, W4 and W8, respectively;

multiplying the remaining one bit of the input information bit stream by an All 1's code; and

outputting the first order Reed-Muller codeword, 16 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the orthogonal codewords and the result of multiplication.

19. An apparatus for coding a 6-bit input information bit stream into a (24,6) codeword comprised of 24 coded symbols, comprising:

a Reed-Muller encoder for receiving the 6-bit input information bit stream and generating a first order Reed-Muller codeword comprised of 32 coded symbols; and

a puncturer for outputting an optimal (24,6) codeword by selecting a coded symbol out of 2^{nd}, 6^{th} and 10^{th} coded symbols from a stream of the 32 coded symbols comprising the first order Reed-Muller codeword, and puncturing the selected coded symbol, 6 coded symbols at intervals of 3 symbols beginning at the selected coded symbol, and a coded symbol at an interval of 1 symbol beginning at a last symbol out of the 6 punctured coded symbols.

20. The apparatus as claimed in claim 19, wherein the puncturer punctures 2^{nd}, 5^{th}, 8^{th}, 11^{th}, 14^{th}, 17^{th}, 20^{th} and 21^{st} coded symbols.

21. The apparatus as claimed in claim 19, wherein the Reed-Muller encoder comprises:

an orthogonal codeword generator for generating orthogonal codewords, each comprised of 32 coded symbols, by multiplying 5 bits out of the 6-bit input information bit stream by associated base orthogonal codes W1, W2, W4, W8 and W16, respectively;

a code generator for generating an All 1's code; and

an adder for outputting the first order Reed-Muller codeword, 32 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the orthogonal codewords and the result of multiplying a remaining one bit of the input information bit stream by the All 1's code.

22. A method for coding a 6-bit input information bit stream into a (24,6) codeword comprised of 24 coded symbols, comprising the steps of:

receiving the 6-bit input information bit stream and generating a first order Reed-Muller codeword comprised of 32 coded symbols; and

outputting an optimal (24,6) codeword by selecting a coded symbol out of 2^{nd}, 6^{th} and 10^{th} coded symbols from a stream of the 32 coded symbols comprising the first order Reed-Muller codeword, and puncturing the selected coded symbol, 6 coded symbols at intervals of 3 symbols beginning at the selected coded symbol, and a coded symbol at an interval of 1 symbol beginning at a last symbol out of the 6 punctured coded symbols.

23. The method as claimed in claim 22, wherein the punctured coded

symbols include 2^{nd}, 5^{th}, 8^{th}, 11^{th}, 14^{th}, 17^{th}, 20^{th} and 21^{st} coded symbols.

24. The method as claimed in claim 22, wherein the step of generating the first order Reed-Muller codeword comprises the steps of:

generating orthogonal codewords, each comprised of 32 coded symbols, by multiplying 5 bits out of the 6-bit input information bit stream by associated base orthogonal codes W1, W2, W4, W8 and W16, respectively;

multiplying the remaining one bit of the input information bit stream by an All 1's code; and

outputting the first order Reed-Muller codeword, 32 coded symbols being the phase-inverted codeword of the orthogonal codewords by XORing the orthogonal codewords and the result of multiplication.

25. A (12,5) decoding apparatus for decoding a 12-bit coded symbol stream into a 5-bit decoded bit stream, comprising:

a zero inserter for outputting a 16-bit coded symbol stream by inserting zero (0) bits at positions of the 12-bit coded symbol stream corresponding to positions of 4 consecutive coded symbols beginning at a selected coded symbol out of 1^{st}, 3^{rd}, 5^{th}, 7^{th}, 9^{th} and 11^{th} coded symbols among the 16 coded symbols comprising a first order Reed-Muller codeword;

an inverse Hadamard transform part for calculating reliabilities by comparing the 16-bit coded symbol stream with every first order Reed-Muller codewords, each comprised of the 16 -bit coded symbol stream, and outputting 5-bit information bit streams corresponding to all of the first order Reed-Muller codewords along with associated reliability values; and

a comparator for comparing reliabilities for all of the first order Reed-Muller codewords, and outputting a 5-bit information bit stream corresponding to a

first order Reed-Muller codeword having a highest reliability as a decoded bit stream.

26. A (12,5) decoding method for decoding a 12-bit coded symbol stream into a 5-bit decoded bit stream, comprising the steps of;

outputting a 16-bit coded symbol stream by inserting zero (0) bits at positions of the 12-bit coded symbol stream corresponding to positions of 4 consecutive coded symbols beginning at a selected coded symbol out of 1^{st}, 3^{rd}, 5^{th}, 7^{th}, 9^{th} and 11^{th} coded symbols among the 16 coded symbols comprising a first order Reed-Muller codeword

calculating reliabilities by comparing the 16-bit coded symbol stream with every first order Reed-Muller codewords, each comprised of the 16-bit coded symbol stream, and outputting 5-bit information bit streams corresponding to all of the first order Reed-Muller codewords along with associated reliability values; and

comparing the reliabilities of all of the first order Reed-Muller codewords, and outputting a 5-bit information bit stream corresponding to a first Reed-Muller codeword having a highest reliability as a decoded bit stream.

27. A (24,6) decoding apparatus for decoding a 24-bit coded symbol stream into a 6-bit decoded bit stream comprising;

a zero inserter for outputting a 32-bit coded symbol by selecting a coded symbol out of 2^{nd} , 6^{th} and 10^{th} coded symbols from a stream of 32 coded symbols comprising the first order Reed-Muller codeword and inserting zero(0) bits at positions of the 24-bit coded symbol stream corresponding to the position of the coded symbol at the selected position, the position of 6 coded symbols at the position having 3 intervals beginning at the selected coded symbol and the position of coded symbol at the position having 1 interval beginning at the last symbol of the

6 coded symbols;

an inverse Hadamard transform part for calculating reliabilities by comparing the 32-bit coded symbol stream with every first order Reed-Muller codewords, each comprised of the 16 -bit coded symbol stream, and outputting 6-bit information bit streams corresponding to all of the first order Reed-Muller codewords along with associated reliability values; and

a comparator for comparing reliabilities for all of the first order Reed-Muller codewords, and outputting a 6-bit information bit stream corresponding to a first order Reed-Muller codeword having a highest reliability as a decoded bit stream.

28. A (24,6) decoding method for decoding a 24-bit coded symbol stream into a 6-bit decoded bit stream, comprising the steps of;

outputting a 32-bit coded symbol by selecting a coded symbol out of 2^{nd}, 6^{th} and 10^{th} coded symbols from a stream of 32 coded symbols comprising the first order Reed-Muller codeword and inserting zero(0) bits at positions of the 24-bit coded symbol stream corresponding to the position of the coded symbol at the selected position, the position of 6 coded symbols at the position having 3 intervals beginning at the selected coded symbol and the position of coded symbol at the position having 1 interval beginning at the last symbol of the 6 coded symbols;

calculating reliabilities by comparing the 32-bit coded symbol stream with every first order Reed-Muller codewords, each comprised of the 16 -bit coded symbol stream, and outputting 6-bit information bit streams corresponding to all of the first order Reed-Muller codewords along with associated reliability values; and

comparing reliabilities for all of the first order Reed-Muller codewords, and outputting a 6-bit information bit stream corresponding to a first order Reed-Muller codeword having a highest reliability as a decoded bit stream.